10/018686

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	
Seiji ONISHI et al.	:	**Attn: BOX PCT**
Serial No. NEW	:	**Docket No. 2001-1823A**
Filed December 20, 2001	:	

OPTICAL PICKUP DEVICE
**[Corresponding to PCT/JP01/04760
Filed June 6, 2001]**

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents,
Washington, DC 20231

Sir:

Prior to examination of the above-referenced U.S. patent application please amend the application as follows:

IN THE SPECIFICATION

Please amend the specification as follows:

Please replace the paragraph beginning at page 4, line 19, to page 5, line 2, with the following rewritten paragraph:

Further, a luminous flux emitted from the second semiconductor laser 22 has its divergence degree converted by the lens 60 as a converting means, is transmitted through the dichroic prism 20 and the polarization beam splitter 40, and is incident on the converging means 30 and transmitted through the coupling lens 31 and the quarter wavelength plate 35 to be a parallel luminous flux of a circularly polarized light. This luminous flux is focused by the diaphragm 36 and is converged onto the second optical disk 24 by the objective lens 32.

Please replace the paragraph beginning at page 18, line 16, to line 23, with the following rewritten paragraph:

In the figure, the optical pickup device according to the second embodiment of the present invention comprises a first light source A, a hologram-detector combination laser unit 2 for a DVD, a beam splitter 3, a collimator lens 4, a prism mirror 5, an objective lens 6, an optical disk 7a for a CD-R, a thin optical disk 7b for a CD-R, a monitor detector 8, a wavelength-selective flat plate 9, a detector 10, a wavelength-selective aperture plate 11, and a diffraction grading 12.

Please replace the paragraphs beginning at page 20, line 17, to page 21, line 13, with the following rewritten paragraphs:

On the other hand, like the first light source A, a light beam with wavelength $\lambda 2$ ($620nm \leqq \lambda 2 \leqq 680nm$) emitted from the second light source B held by the hologram-detector combination laser unit 2 for a DVD is reflected at the wavelength-selective flat plate 9, is further reflected at the beam splitter 3, so as to approximately coincide with an optical axis of the light beam from the first light source A. Thereafter, the light beam is converted to a parallel light beam by the collimator lens 4, is reflected on the surface of the prism mirror 5, and thereafter it passes through the wavelength-selective aperture plate 11, is converged at the objective lens 6, and forms a desired optical spot on a recording surface of the thin optical disk 7b for a DVD.

Next, the light beam reflected on the recording surface of the thin optical disk 7b passes through the objective lens 6 and the wavelength-selective aperture plate 11 again, is reflected on the surface of the prism mirror 5, passes through the collimator lens 4, is reflected at the beam splitter 3, is further reflected at the wavelength-selective flat plate 9, and is detected at a detector part in the hologram-detector combination laser unit 2 for a DVD having the second light source B.

<u>IN THE CLAIMS</u>

Please amend the claims as follows:

4. (Amended) The optical pickup device as defined in Claim 1, wherein

a light path length converting means for lengthening light path length of a light is provided between the synthesizing means and the converging means.

6. (Amended) The optical pickup device as defined in Claim 1, wherein

when imaging magnification that is accomplished by an optical element between the first light source and the optical disk is made M1 and imaging magnification that is accomplished by an optical element between the second light source and the optical disk is made M2, $1.5 \leqq M2/M1$.

7. (Amended) The optical pickup device as defined in Claim 1 further including:

an aperture diaphragm for moving with the converging means and converging a light beam spot of desired size onto the optical disks.

8. (Amended) The optical pickup device as defined in Claim 1, wherein

when imaging magnification of the converging means with respect to the first light source is made m1, the following conditional expression is satisfied:

$| m1 | \leqq 0.068$.

9. (Amended) The optical pickup device as defined in Claim 1, wherein

when numerical aperture on the side of the optical disk corresponding to the combination of the first light source and the optical disk is made NA1, and numerical aperture on the side of the optical disk corresponding to the combination of the second light source and the optical disk is made NA2, and

when the imaging magnification of the converging means with respect to the first light source is made m1, and imaging magnification of the converging means with respect to the second light source is made m2, the following conditional expressions are satisfied:

$NA1 < NA2$,

$| m2 | \leqq | m1 |$.

10. (Amended) The optical pickup device as defined in Claim 1, wherein

when wavelength of the light beam emitted from the first light source is made $\lambda 1$, and wavelength of the light beam emitted from the second light source is made $\lambda 2$,

$760nm \leqq \lambda 1 \leqq 810nm$,

$620nm \leqq \lambda 2 \leqq 680nm$.

11. (Amended) The optical pickup device as defined in Claim 1, wherein

the light beams as divergent lights emitted from the first and second light sources are incident on the synthesizing means, thereby scattering a reflected light on the surface of the synthesizing means.

REMARKS

The present Preliminary Amendment is submitted to make minor editorial changes so as to generally improve the form of the specification and to delete the multiple dependency of the claims, thereby placing such claims in condition for examination and reducing the required PTO filing fee.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current Preliminary Amendment. The attached page is captioned "**Version With Markings to Show Changes Made**".

Respectfully submitted,

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means 30, the coupling lens 31 makes the lights emitted from the polarization beam splitter 40 parallel lights, the quarter wavelength plate 35 converts the parallel lights from linear polarized lights into circularly polarized lights, and the diaphragm 36 restricts the size of required aperture and converges and focuses the parallel lights onto the surface of the optical disk through the objective lens.

Next, the luminous flux reflected from the surface of the optical disk 24 is transmitted through the objective lens 32, the quarter wavelength plate 35, and the coupling lens 31 again and is incident on the polarization beam splitter 40. The light reflected at the polarization beam splitter 40 is received by the light receiving means 50. The light receiving means 50 detects distribution change of quantity of the light reflected from the surface of the optical disk 24 by the light detector 51, and performs focus detection, track detection, and reading of information by the arithmetic processing circuit which is not shown.

19 Further, a luminous flux emitted from the second semiconductor laser 22 has its divergence degree converted by the lens 60 as a converting means, is transmitted through the dichroic prism 20 and the polarization beam splitter 40, and is incident on the converging means 30 and transmitted through the coupling lens 31 and the quarter wavelength plate 35 to be a parallel luminous flux of a circularly polarized light. This

luminous flux is focused by the diaphragm 36 and is converged onto the second optical disk [10] 24 by the objective lens 32.

The luminous flux reflected from the second optical disk 24 is transmitted through the objective lens 32, the quarter wavelength plate 35, and the coupling lens 31 again, is incident on the polarization beam splitter 40 to be reflected, is given astigmatism by the cylindrical lens 52, and is incident on the light detector 51, thereby obtaining a read signal for information recorded on the optical disk 24 employing a signal outputted from the light detector 51.

Generally, however, when data are recorded onto the optical disk, a converged light quantity which is several times as large as that for reproduction is required, and thus the lens as a converting means for converting divergence degree of a light beam is required to be provided in one of light paths so as to enable acquisition of sufficient quantity of converged light for recording in the "OPTICAL PICKUP DEVICE" disclosed in the Japanese Published Patent Application No. Hei. 10-199021.

Therefore, a compact and simplified optical pickup device is hard to be designed for a pickup device for CD-R (recordable compact disk) which includes a circuit for controlling the quantity of output light from the light source.

Further, because an optical system employed for DVD reproduction is desired to have reproduction compatibility with DVD-RAM standard or the like, it is required to have a higher

optical disk can be reduced.

While a description has been given of the first embodiment which employs the prism mirror 5 as a light path length converting means for lengthening light path length of lights, the light path length converting means is not restricted thereto, and anything, such as one employing material having high refractive index for internal reflection, can be employed as long as it lengthens light path length of lights.

(Embodiment 2)

Hereinafter, an optical pickup device according to a second embodiment of the present invention will be described with reference to figure 2.

Figure 2 is a schematic diagram exemplifying the optical pickup device according to the second embodiment of the present invention.

In the figure, the optical pickup device according to the second embodiment of the present invention comprises a first light source A, a hologram-detector combination mold laser unit 2 for a DVD, a beam splitter 3, a collimator lens 4, a prism mirror 5, an objective lens 6, an optical disk 7a for a CD-R, a thin optical disk 7b for a CD-R, a monitor detector 8, a wavelength-selective flat plate 9, a detector 10, a wavelength-selective aperture plate 11, and a diffraction grading 12.

The optical pickup device according to the second embodiment differs from the optical pickup device according to

transmitted through the beam splitter 3, is emitted from the collimator lens 4 as a divergent light, is reflected on the surface of the prism mirror 5, passes through the wavelength-selective aperture plate 11, is converged at the objective lens 6, and forms a desired optical spot on a recording surface of the optical disk 7a for a CD-R.

Next, the light beam reflected on the recording surface of the optical disk 7a passes through the objective lens 6 and the wavelength-selective aperture plate 11 again, is reflected on the surface of the prism mirror 5, passes through the collimator lens 4, is reflected at the beam splitter 3, is further transmitted through the wavelength-selective flat plate 9, and is detected at the detector 10. At this time, focus detection can be performed by well-known methods such as an astigmatism method and a knife-edge method, and track detection can be performed by a push-pull method or a 3-beam method.

On the other hand, like the first light source A, a light beam with wavelength $\lambda 2$ ($620nm \leqq \lambda 2 \leqq 680nm$) emitted from the second light source B held by the hologram-detector combination mold laser unit 2 for a DVD is reflected at the wavelength-selective flat plate 9, is further reflected at the beam splitter 3, so as to approximately coincide with an optical axis of the light beam from the first light source A. Thereafter, the light beam is converted to a parallel light beam by the collimator lens 4, is reflected on the surface of

the prism mirror 5, and thereafter it passes through the wavelength-selective aperture plate 11, is converged at the objective lens 6, and forms a desired optical spot on a recording surface of the thin optical disk 7b for a DVD.

Next, the light beam reflected on the recording surface of the thin optical disk 7b passes through the objective lens 6 and the wavelength-selective aperture plate 11 again, is reflected on the surface of the prism mirror 5, passes through the collimator lens 4, is reflected at the beam splitter 3, is further reflected at the wavelength-selective flat plate 9, and is detected at a detector part in the hologram-detector combination mold laser unit 2 for a DVD having the second light source B.

As described above, in the optical pickup device according to the second embodiment, the prism mirror 5 as a light path length converting means for lengthening light path length (air reduction length) is provided between the beam splitter 3 as a synthesizing means and the objective lens 6 as a converging means, so that the synthesizing means can be made close to the converging means and a compact design of the optical system itself is possible, whereby downsizing, weight saving, and thinning of the optical pickup device can be realized, random access and degree of mechanical freedom of the loading system are improved, and weight saving of a drive can be realized.

Further, the beam splitter 3 as a synthesizing means is

a converting means for converting the light beam outputted from the synthesizing means into parallel lights.

3. The optical pickup device as defined in Claim 2, wherein

when a back focus of the converting means for the wavelength of the first light source is f1 and a back focus of the converting means for the wavelength of the second light source is f2, the first light source is located at a position nearer to the converting means than f1 is, while the second light source is located at a position farther from the converting means than f2 is.

Claim 1

4. The optical pickup device as defined in any of Claims 1 to 3, wherein

a light path length converting means for lengthening light path length of a light is provided between the synthesizing means and the converging means.

5. The optical pickup device as defined in Claim 4, wherein

the light path length converting means is made of material having high refractive index.

Claim 1

6. The optical pickup device as defined in any of Claims 1 to 5, wherein

when imaging magnification that is accomplished by an

optical element between the first light source and the optical disk is made M1 and imaging magnification that is accomplished by an optical element between the second light source and the optical disk is made M2, 1.5 $\leqq$ M2/M1.

7. The optical pickup device as defined in Claim 1 any of Claims 1 to 6 further including:

an aperture diaphragm for moving with the converging means and converging a light beam spot of desired size onto the optical disks.

8. The optical pickup device as defined in Claim 1 any of Claims 1 to 7, wherein

when imaging magnification of the converging means with respect to the first light source is made m1, the following conditional expression is satisfied:

$| m1 | \leqq 0.068$.

9. The optical pickup device as defined in Claim 1 any of Claims 1 to 8, wherein

when numerical aperture on the side of the optical disk corresponding to the combination of the first light source and the optical disk is made NA1, and numerical aperture on the side of the optical disk corresponding to the combination of the second light source and the optical disk is made NA2, and

when the imaging magnification of the converging means with respect to the first light source is made m1, and imaging magnification of the converging means with respect to the second light source is made m2, the following conditional expressions are satisfied:

$NA1 < NA2$,

$| m2 | \leqq | m1 |$.

10. The optical pickup device as defined in Claim 1 ~~any~~ of Claims 1 to ~~9~~, wherein

when wavelength of the light beam emitted from the first light source is made $\lambda 1$, and wavelength of the light beam emitted from the second light source is made $\lambda 2$,

$760nm \leqq \lambda 1 \leqq 810nm$,

$620nm \leqq \lambda 2 \leqq 680nm$.

11. The optical pickup device as defined in Claim 1 ~~any~~ of Claims 1 to ~~10~~, wherein

the light beams as divergent lights emitted from the first and second light sources are incident on the synthesizing means, thereby scattering a reflected light on the surface of the synthesizing means.